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WETLAND STATUS OF HILLSIDE BOGS, WETLAND PINE SAVANNAS, AND MUCK BOGS IN THE WEST GULF COASTAL PLAIN

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ABSTRACT

The wetland status of West Gulf Coastal Plain hillside bogs, wetland pine savannas, and muck bogs is apparently equivocal. We examined regulatory and nonregulatory wetland definitions and found that these plant communities conform to all wetland criteria and therefore should be recognized as wetlands.

KEY WORDS: Hillside bog, wetland pine savanna, muck bog, wetlands, pitcher plants

INTRODUCTION

In pre-European times, bogs and wetland pine savannas covered two to four million acres of the West Gulf Coastal Plain (WGCP). These were open areas with generally low tree densities, high water tables, and a rich predominately heliophilous, hydrophytic herbaceous ground cover (Bridges & Orzell 1989; Harcombe *et al.* 1993). Today, only one to five percent of the original acreage remains, most of which is badly degraded. These communities once covered extensive acreage in the East Gulf Coastal Plain and the Atlantic Coastal Plain as well (Brewer 1998; Folkerts 1982, 1991; Hermann 1995).

Having recently completed floristic inventories on bogs and wetland pine savannas in the WGCP (MacRoberts & MacRoberts 1988, 1990, 1991, 1992, 1993, 1998a, 1998b), we were surprised to find that the wetland status of these communities is uncertain, even though there are clear jurisdictional/regulatory and scientific definitions that point to their being wetlands.

The U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service provide regulatory definitions and procedures for identifying wetlands (Cowardin *et*

al. 1979; U.S. Army Corps of Engineers Delineation Manual 1987 [COE Manual 1987]; Federal Manual for Identifying and Delineating Jurisdictional Wetlands 1989 [Federal Manual 1989]; Fretwell *et al.* 1996; National Research Council 1995 [NRC 1995]; Policansky 1998; Reed 1988 and 1996 update; U.S. Soil Conservation Service 1991 [U.S. Soil 1991]; Tiner 1988, 1996). Three criteria are used to designate wetlands: hydrology, soils, and vegetation. The National Wetland Inventory (1974-1987) has produced maps showing where wetlands occur.

In this paper we address the wetland status of WGCP hillside bogs, wetland pine savannas, and muck bogs. Detailed descriptions of these and similar sites can be found elsewhere (Bridges & Orzell 1989; Harcombe *et al.* 1993; Kral 1955; Lodwick 1975; MacRoberts & MacRoberts 1988, 1990, 1991, 1992, 1993, 1998a, 1998b; Nixon & Ward 1986; Rowell 1949; Streng & Harcombe 1982). We will be concerned especially with plants since we have conducted floristic inventories of bogs and wetland pine savannas.

STUDY SITES

Our sample consists of seventeen bogs and wetland pine savannas in the WGCP: thirteen hillside bogs, two wetland pine savannas, and two muck bogs. The locations of the seventeen sites are shown in Figure 1. Andrew's and Chester's muck bogs (A-MB, C-MB) are on the Gus Engeling Wildlife Management Area, Anderson County, Texas. Cooter's hillside bog (C-HB) is on the Vernon Ranger District of the Kisatchie National Forest, Vernon Parish, Louisiana. Fixit, Middle Branch, Vine, Penrod, RCW, Robin, Sparrow, Woodcock, 360A, and 360B hillside bogs (NATCH) are on the Kisatchie Ranger District of the Kisatchie National Forest, Natchitoches Parish, Louisiana. Strange Road hillside bog (SR-HB) is on the Winn Ranger District of the Kisatchie National Forest, Natchitoches Parish, Louisiana. Turkey Creek and Lance Rosier wetland pine savannas (TC-WPS, LR-WPS) occur on the Big Thicket National Preserve, Hardin and Tyler counties, Texas. "TX-HB" hillside bog is a composite created by combining various incomplete lists taken from Nixon & Ward (1986) and Orzell (1990) and our personal observations on a group of hillside bogs centering on Boykin Springs, Angelina National Forest, Angelina and Jasper counties, Texas. The composite is an attempt to produce a representative hillside bog floristics for this region of east Texas, comparable to our other sites.

Except for TX-HB, we conducted year-round floristic inventories on each bog or wetland pine savanna in the sample. Each was visited every two to four weeks from March through November. We developed complete plant lists for these sites. That is, our surveys were designed to identify all the vascular plant species that grew within each bog or wetland pine savanna. Individual site plant lists range from 64 species at the very small Robin hillside bog (0.03 ha) to 131 species at the large Cooter's hillside bog (3.0 ha). The mean site, which measured between 0.4 and 0.8 ha, had 98 species.

Soil maps are available for all sites (Coffee 1975; Deshotels 1987; Martin 1990), but many sites are so small as not to have been mapped separately from the surrounding landscape. We have made observations on hydric conditions at all sites.

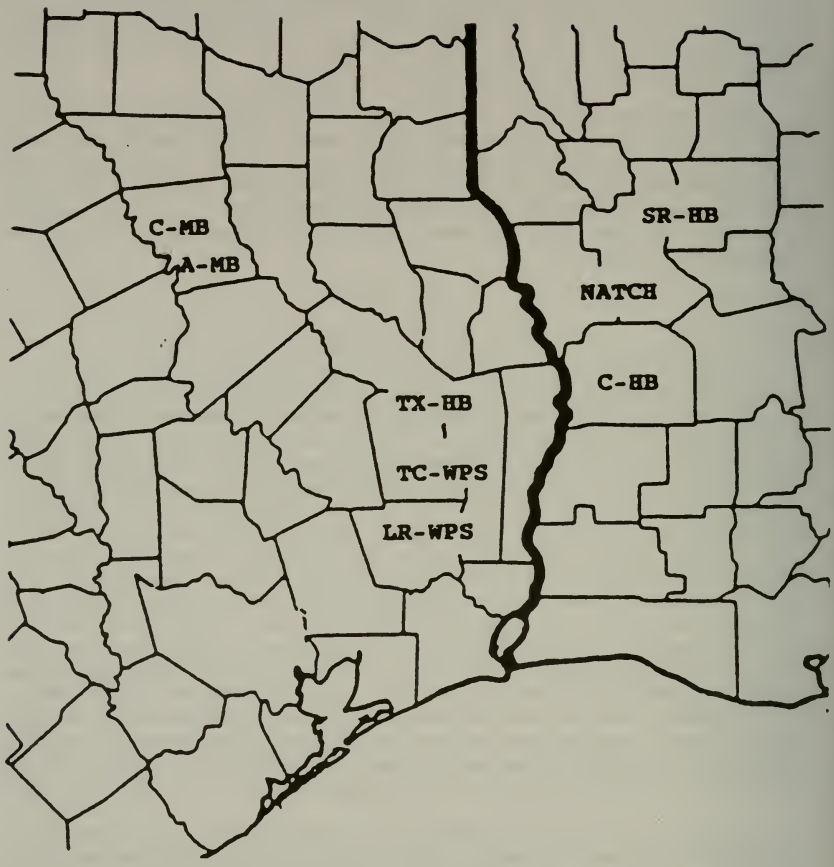

Figure 1. Study site locations.

DEFINITIONS

The Federal Manual (1989) defines wetlands as having ". . . one or more of the following three attributes: (1) at least periodically, the land supports predominately hydrophytes, (2) the substrate is predominately undrained hydric soil, and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year" (see also Cowardin *et al.* 1979). U.S. Soil (1991) and the COE Manual (1987) define wetlands very similarly (Tiner 1996; NRC 1995). However, the COE Manual (1987) states that all three criteria, not just "one or more," must be met before a site can be delineated as a wetland. While the NRC (1995) provides a "scientific" -- not a "regulatory" -- definition of wetlands (Policansky 1998), it stipulates virtually the same criteria and repeats the trio: recurrent, sustained inundation or saturation at or near the surface; hydric soils; and hydrophytic vegetation, but emphasizes that hydrophytic vegetation, by definition, indicates hydric soils.

Below, we examine each of the criteria used in these definitions to determine whether or not WGCP bogs and wetland pine savannas are classifiable as wetlands. A history of wetlands in the United States is given by Vileisis (1997) and a history of the involvement of the Corps of Engineers in water matters in the United States is given in Shallat (1994).

VEGETATION

Vegetation appears to be the defining criterion for wetlands that is most emphasized by all agencies. The U.S. Fish and Wildlife Service has produced a national plant list that ranks species on a wetland (hydrophytic) gradient (Reed 1988, 1996 update). According to the Federal Manual (1989:5):

> An area has hydrophytic vegetation when, under normal circumstances: (1) more than 50 percent of the composition of the dominant species from all strata are obligate wetland (OBL), facultative wetland (FACW), and/or facultative (FAC) species, or (2) a frequency analysis of all species within the community yields a prevalence index value of less than 3.0 (where OBL = 1.0, FACW = 2.0, FAC = 3.0, FACU = 4.0, and UPL = 5.0).

Reed (1988) defines these five categories of plant species: 1) obligate wetlands (OBL): greater than 99% occurrence in wetlands; 2) facultative wetland (FACW): 67% - 99% occurrence in wetlands, but occasionally found in nonwetlands; 3) facultative (FAC): equally likely to occur in wetlands or nonwetlands (estimated probability 34% - 66%); 4) facultative upland (FACU): usually occur in nonwetlands (estimated probability 67% - 99%), but occasionally found in wetlands; and 5) obligate uplands (UPL): occurs almost always (estimated > 99%) in nonwetlands.

Table 1 compares percentage frequency of all plants from our sample of seventeen sites as rated by Reed's (1988) hydrophytic classification. Table 1 also gives the prevalence index and the total number of species at each site. We compared the 1996 update of Reed's listing with the 1988 original and found the two to be virtually identical. Since there is no significant difference between the two lists, we use Reed (1988).

Table 1. Species percents by wetland gradient categories, prevalence index, and sample size (HB = hillside bog, MB = muck bog, WPS = wetland pine savanna).

Site	OBL	FACW	FAC	FACU	UPL	Prev. Index	Sample size
Andrew's MB	60	31	9	0	0	1.49	104
Chester's MB	58	30	10	1	1	1.57	118
Cooter's HB	44	40	11	5	0	1.77	131
TX HB	46	32	17	4	1	1.80	130
Turkey Creek WPS	40	38	18	3	1	1.87	106
Middle Branch HB	40	33	22	4	1	1.93	106
Fixit HB	38	38	17	6	1	1.93	104
Lance Rosier WPS	32	44	20	4	0	1.96	117
Vine HB	40	31	19	10	0	1.99	72
Strange Rd. HB	30	42	19	8	1	2.01	95
RCW HB	38	33	19	10	0	2.01	69
Robin HB	38	33	20	9	0	2.02	64
Penrod HB	36	38	17	7	2	2.03	104
Sparrow HB	38	31	20	11	0	2.03	65
Woodcock HB	36	37	18	8	1	2.05	99
360B HB	31	39	21	9	0	2.07	90
360A HB	31	35	22	10	2	2.17	100

The flora of these sites is clearly dominated by hydrophytes. Between 88% and 100% of species at each site are OBL, FACW, and FAC (50% or higher qualifies a site as wetland). The prevalence index ranges from 1.49 to 2.17 (3.0 and lower qualifies as wetlands). The few FACU or UPL species that occur in these sites are either intruders taking advantage of microhabitat, are species misclassified by Reed (1988, 1996 update), or are species with wide hydric tolerance. For example, in the WGCP, *Marshallia tenuifolia* Raf. probably should be classified as a FACW species, and *Pinus palustris* Mill., *Pityopsis graminifolia* (Michx.) Nutt., and *Liatris pycnostachya* Michx. have a wide hydric tolerance that ranges from saturated to xeric soils (Bridges & Orzell 1989; MacRoberts & MacRoberts 1993, 1996; Marks & Harcombe 1981).

No matter. A few disputable assignments make no difference. The figures are clear. All these sites are unquestionably vegetationally wetlands.

Finally, if any additional evidence of the hydrophytic nature of the vegetation of hillside bogs, wetland pine savannas, and muck bogs be needed, the only sources required to identify virtually all vascular plants occurring in WGCP bogs and wetland pine savannas are either Godfrey & Wooton's (1979, 1981) *Aquatic and Wetland Plants of the Southeastern United States* or Correll & Correll's (1972) *Aquatic and Wetland Plants of Southwestern United States.*

WATER

The main hydrological criterion for wetlands is "permanent or periodic inundation, or soil saturation, for a significant period (usually a week or more) during the growing season" (Federal Manual 1989:15). Wetland pine savannas are poorly to very poorly drained and have high water tables. From winter through spring, they have standing, shallow water most of the time and periodically throughout the growing season (Bridges & Orzell 1989; Deshotels 1978; Harcombe *et al.* 1993; MacRoberts & MacRoberts pers. obs.; Streng & Harcombe 1982) although there are droughty periods in the summer and early autumn when the water table lowers. Both hillside bogs and muck bogs are saturated year round: the former from lateral movement of water from higher ground; the latter from both lateral movement of water, but also from standing water (MacRoberts & MacRoberts pers obs.).

SOILS

U.S. Soil (1991:1) defines a hydric soil as ". . . a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part" (see also Federal Manual 1989:6; Tiner 1996). U.S. Soil (1991) and the COE Manual (1987) list soils in the United States by series and subgroup considered to be hydric. The soils upon which hillside bogs, wetland pine savannas, and muck bogs occur -- Guyton, Jasco, Waller, Plank, Bienville, Anacoco, Wehadkee, and Nahatche (vertic Albaqualfs, typic Glossaqualfs, typic Fragiaqualfs, psammentic Paleudalfs, aeric and typic Fluvaquents) -- are listed as hydric (U.S. Soil 1991; COE Manual 1987).

NATIONAL WETLANDS INVENTORY MAPS

As part of this investigation we examined the most recent National Wetlands Inventory Maps (1974-1987) to see how the sites in our sample of hillside bogs, wetland pine savannas, and muck bogs were delineated. Except for the two muck bogs, none of the sites was designated as wetland. What the maps delineate as

wetlands are ponds, major streams, and those locations on topographic maps marked by "swamp" symbols; the remaining land is marked "upland." Thus, if an area was not obviously a wetland by the fact of open water or was clearly marked as swamp on a topographic map, it was designated an upland.

DISCUSSION

By all agency criteria, hillside bogs, wetland pine savannas, and muck bogs are wetlands. Using the Cowardin *et al.* (1979) and Tiner (1988) "keys" for determining wetlands, WGCP wetland pine savannas and hillside bogs are palustrine, persistent, emergent, saturated wetlands; muck bogs are palustrine scrub-shrub or emergent wetlands.

One of the peculiarities of the Corps of Engineers methodology that is often lost sight of is the three factor requirement whereby criteria established for vegetation, soils, and water must all be met (COE Manual 1989). However, as NRC (1995) points out, what this requirement overlooks is the strong causal relationship among water, soils, and vegetation. For example, plant communities dominated by OBL and FACW species develop only where the prevailing hydrologic regime is one in which flooding and saturation is frequent or extended. In fact, the situation is even more elementary since water, soils, and vegetation are interdependently defined. Hydrophytic vegetation, by definition, is associated with water; it is called hydrophytic because of its aquatic or wetland association. Thus, a strict requirement that soils, hydrology, and vegetation all meet "wetland" criteria is redundant at best, obfuscatory at worst, and becomes an exercise in excess or redundancy (see NRC 1995:139-140.).

Most definitions of wetlands establish sampling procedures that prove to be ambiguous (*e.g.*, COE Manual procedures). We solved the problems arising from ambiguously defined "dominant species" or "stratum" by surveying year round and developing a total floristic list. In this way, all species that grow in a specific site are included and bias resulting from seasonal sampling or sampling that favors large, conspicuous, showy, or easily identified species such as longleaf pine or pitcher plants is avoided. Rare, small species, such as *Bartonia verna* (Michx.) Muhl. and *Burmannia capitata* (Gmel.) Mart., and species difficult to identify, such as members of the genera *Rhynchospora* and *Carex*, that are excellent indicators of hydrological conditions are not discriminated against in favor of species that are easily identified but which are not particularly good hydrological indicators.

While the agencies have produced universal lists of hydric soils and hydrophytic plants, they have not produced universal keys to or lists of wetland plant communities. This means that at each site, individual plants must be collected and analyzed instead of using a simple key to decide community. Such keys have been developed locally by Marks & Harcombe (1981) and Cowardin *et al.* (1979), which can be employed with almost no detailed knowledge of the vegetation.

Why there is ambiguity in classifying bogs and wetland pine savannas is difficult to understand. We conclude that it is due to the three-factor requirement of the Corps of Engineers, coupled with the fact that few individuals are botanically sophisticated

enough to assess the local flora, either by sampling it as prescribed in the manuals or by conducting a year-round inventory involving the identification of all species. It is interesting that wetland pine savannas in the Carolinas, Georgia, and Florida are recognized as wetlands, yet these same communities in Alabama, Mississippi, Louisiana, and Texas are not (Fretwell *et al.* 1996).

Suffice it to say that far larger areas of our landscape are wetlands than are so designated on wetland inventory maps.

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